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CODE OF PRACTICE FOR DESIGN, FABRICATION AND MAINTENANCE OF NAIL-JOINTED TIMBER POSTS FROM SMALL DIMENSIONAL TIMBER FOR OVERHEAD ELECTRIC DISTRIBUTION LINES FOR LOW VOLTAGES

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CODE OF PRACTICE FOR DESIGN, FABRICATION AND MAINTENANCE OF NAIL-JOINTED TIMBER POSTS FROM SMALL DIMENSIONAL TIMBER FOR OVERHEAD ELECTRIC DISTRIBUTION LINES FOR LOW VOLTAGES

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CODE OF PRACTICE FOR DESIGN, FABRICATION AND MAINTENANCE OF NAIL-JOINTED TIMBER POSTS FROM SMALL DIMENSIONAL TIMBER FOR OVERHEAD ELECTRIC DISTRIBUTION LINES FOR LOW VOLTAGES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 22 April 1975, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Despite the recent progress made in developing efficient and economical underground cables or cables carried in conduits system for electric distribution and transmission, it appears that it will be several years, before such construction will be able to compete effectively with overhead construction. Overhead lines on steel poles, tubular poles or concrete posts are in use in urban areas as they are found cheaper in the long run. But in rural and forest areas, solid wood pole, jointed as well as unjointed from a few species have been in use for the last many years (*see* IS : 876-1970* and IS : 5978-1970†). Electric distribution posts made from small dimensional timber pieces are easily available at lower cost, easy in treatment and fabrication. These posts can be fabricated at the erection site resulting in overall economy.

0.3 This code of practice for design, fabrication and maintenance of nail jointed timber overhead power distribution posts made from small dimensional timber has been prepared with a view to make use of best possible way, small timber pieces available in rural areas economically.

0.4 In the formulation of this standard due weightage has been given to international co-ordination among the standards and practices prevailing in different countries in addition to relating it to the practices in the field in this country.

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*Specification for wood poles for overhead power and telecommunication lines (*second revision*).

†Code of practice for design of wood poles for overhead power and telecommunication lines.

0.5 In the preparation of this standard, considerable assistance has been rendered by the Forest Research Institute and Colleges, Dehra Dun.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the design, fabrication and maintenance of nail-jointed timber posts for overhead electric distribution lines for low voltages made from small dimensional timber pieces.

2. TERMINOLOGY

2.1 For the purpose of this standard the definitions given in IS : 707-1968† shall apply.

3. NECESSARY INFORMATION FOR EFFICIENT PLANNING AND DESIGN

3.1 For efficient planning and design of overhead electric distribution posts made from small dimensional timbers, the following information shall be procured by those responsible for the work:

a) Species and grading of timber available,
b) Moisture content of timber, and
c) Details of pre-treatment.

4. MATERIALS

4.1 Timber — Timber used for fabrication of overhead electric distribution posts shall be any of the species of timber specified in Appendix A. The minimum thickness of planks shall be not less than 45 mm.

4.1.1 *Defects in Sawn Timber* — The permissible defects in sawn timber for overhead electric posts shall be as specified in IS : 3629-1966‡.

4.2 Nails — The nails used for timber joints shall be plain head nail with diamond points (*see* IS : 723-1972§) and galvanized nails.

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*Rules for rounding off numerical values (*revised*).

†Glossary of terms applicable to timber and timber products (*first revision*).

‡Specification for structural timber in building.

§Specification for steel countersunk head wire nails (*first revision*).

5. DESIGN CONSIDERATIONS

5.1 A timber post for overhead electric distribution at straight line locations is subjected to static bending caused by the following loadings:

a) Wind load on the surface of the post above the ground,

b) Wind load on the conductors and ground wires acting on the horizontal span, and

c) Unbalanced pull in the longitudinal direction due to breakage of wires.

5.2 A timber post, for overhead electric distribution at angle locations, when guy-rope stay is fixed in the ground, is subjected to vertical downward load on the post.

5.3 The wind pressure on post, conductors and wires shall be in accordance with IS : 802 (Part I)-1973* or in accordance with Indian Electricity Rules.

6. PRINCIPLE OF DESIGN

6.1 Overhead Posts

6.1.1 Timber post made from small dimensional timbers at straight line locations shall be designed as simple cantiliver using the fundamental bending formula:

$$M=fZ \text{ or } Z=M/f$$

where

M = design bending moment in kg/mm,

f = maximum allowable stress in bending for the type of timber used in kg/mm^2, and

Z = modulus of section required in mm^3.

6.1.2 At angle locations, where the post may be subjected to vertical downward as well as bending load as stated in **5**, the timber post shall be designed as a column as in accordance with IS : 883-1970†.

6.2 Joints of Timber Posts with Nail Connectors

6.2.1 The design of the joints in timber posts shall conform to IS : 4983-1968‡.

6.2.2 The joints shall be designed for loads and forces as given in **5**.

6.2.3 The number of joints may depend on the sizes of the timber available and the clearance above the ground level. (*See* IS : 1331-1971§.) The number of joints shall be reduced as far as possible. Two type designs are available at Forest Research Institute and Colleges for reference with the following data:

---

*Code of practice for use of structural steel in overhead transmission line towers: Part I Loads and permissible stresses.

†Code of practice for design of structural timber in building (*third revision*).

‡Code of practice for design and construction of nailed laminated timber beams.

§Cut sizes of timber (*first revision*).

Maximum height of the post = 8·25 m above ground level

7. FOUNDATION

7.1 The design and construction of foundation for timber post shall be in accordance with the provisions laid down in IS : 4091-1967*.

8. PRESERVATIVE TREATMENT

8.1 The recommended preservatives for sawn timber for outside locations are given in Table 1. The composition of the preservatives to be used for treatment shall be as laid down in IS : 401-1970†.

TABLE 1 PRESERVATIVE TREATMENT

DESCRIPTION (1)	TYPE OF TREATMENT (2)	PRESERVATIVES (3)
Timber under choice one, two and three as given in Appendix A	Pressure process or hot and cold process (if applicable)	a) Creosote or creosote fuel oil mixture (50 : 50) b) Copper-chrome arsenic composition

8.2 Necessary anti-termite measure shall be carried out according to IS : 6313 (Part II)-1971‡.

9. FOUNDATION DETAILS OF THE POSTS

9.1 One of the following procedures shall be adopted for making the foundation of the post:

a) Posts are kept well above ground level raised over cement concrete dwarf pillar and fixed in position by means of MS channels, bolts.

b) Posts are buried in ground and encased with cement concrete dwarf foundation.

10. FABRICATION

10.1 In the fabrication and erection of the timber post, it shall be ensured that most of the visible defects are, as far as possible, farthest away from points of maximum stress.

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*Code of practice for design and construction of foundations for transmission lines towers and poles.

†Code of practice for preservation of timber (*second revision*).

‡Code of practice for anti-termite measures in buildings: Part II Pre-constructional chemical treatment measures.

10.2 The fabrication shall be done in stages as given in **10.2.1** to **10.2.4.** The method for the nailing of the joints shall be same as given in IS : 2366-1963* (*see* Fig. 1).

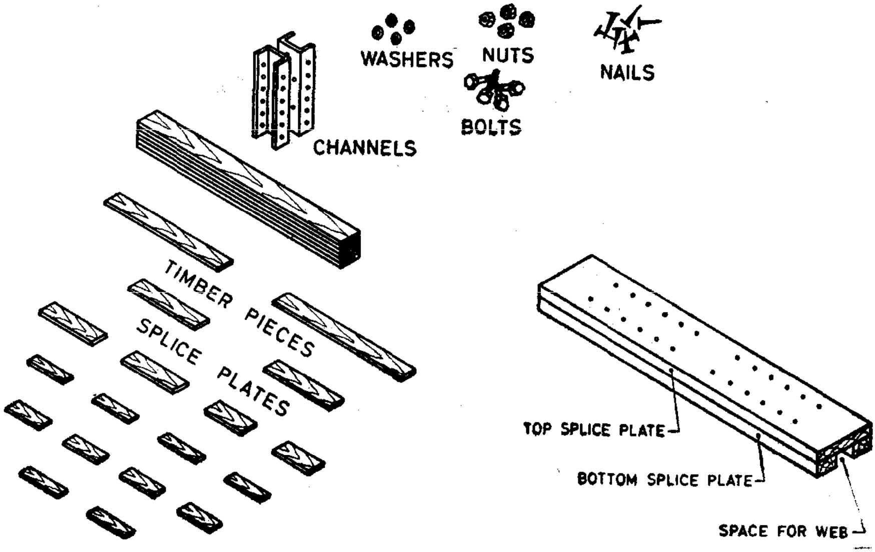
10.2.1 *Stage A* — Planks shall be prepared according to the sizes shown in the relevant drawing. The required number of splice plates shall also be dressed and cut to proper sizes. Quantities of nails of various lengths and gauges (diameters) as described in the relevant drawing shall be procured. Drilling bits of the required gauges to carry out the preboring operation shall be procured.

10.2.2 *Stage B* — On a level platform or ground, the dimensions of the post, clearly showing the flanges and web, shall be marked. The position and thickness of the splice plates shall also be marked on the ground.

10.2.3 *Stage C*

10.2.3.1 Nail distances shall be marked on hardboard or plywood templates of various sizes as per drawings. These distances shall be transferred on the splice plates and necessary preboring shall be done in pairs.

10.2.3.2 The two flanges and the web shall be fabricated separately according to drawing, using a pair of splice plates at the various lengthening



1A Miscellaneous Processed Timber and Hardware for one Post

1B Preboring Splices and Plates jointly

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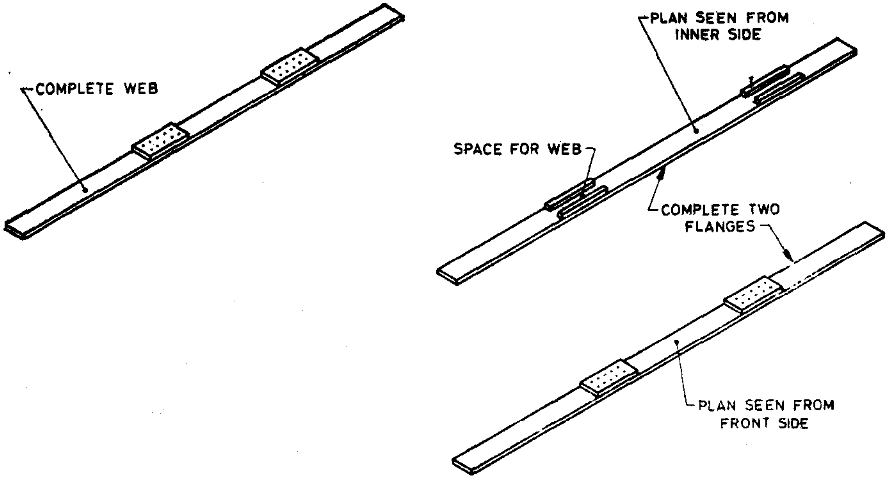
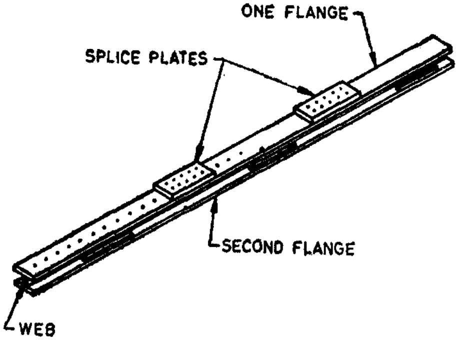
*Code of practice for nail-jointed timber construction.



1C Fabricating the complete web of the post from short length planks

1D Fabricating two flanges separately (nailing of the central row of all lengthening joints in the flanges shall be done while connecting web to the flanges)



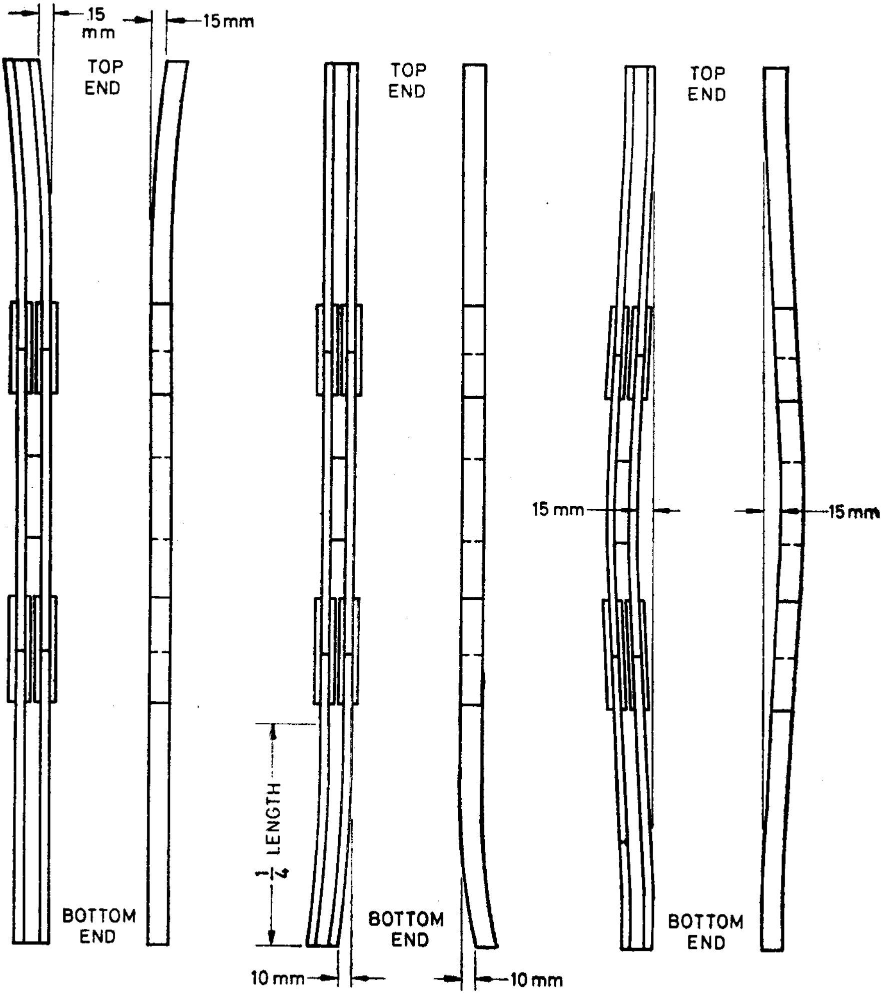
1E Jointing of web to the flanges forming a net I-section, ready for inspection before erection

FIG. 1 FABRICATION TECHNIQUE

joints. Nailing of the central row of lengthening joints in flanges shall be done while connecting web to the flanges.

10.2.4 *Stage D* — The flanges and web shall be jointed to each other forming a net I-Section.

10.3 The electric post shall be fabricated straight on a levelled platform. The limits of deviation are shown in Fig. 2.



15 mm at the top and in either direction measured from the straight line joining two end points

10 mm at the bottom end in either direction measured from the straight line joining a point at bottom end and point at $\frac{1}{4}$th length

15 mm at centre in either direction measured from the straight line joining two end points

FIG. 2 LIMITS OF DEVIATIONS

11. SETTING AND ERECTION PRECAUTION

11.1 Setting of Foundation — The setting of the foundation shall be as given in **11.1.1** to **11.1.4**.

11.1.1 After the alignment is laid out, foundation of the post shall be excavated just equal to the required depth.

11.1.2 Timber post shall rest on M15 concrete layer of minimum 100 mm and shall have a concrete cover of 75 mm.

11.1.3 If the post is burried in ground, concrete encasing shall be done after erecting the post in position.

11.1.4 Dwarf concrete base of specified mix of cement concrete shall be laid in position.

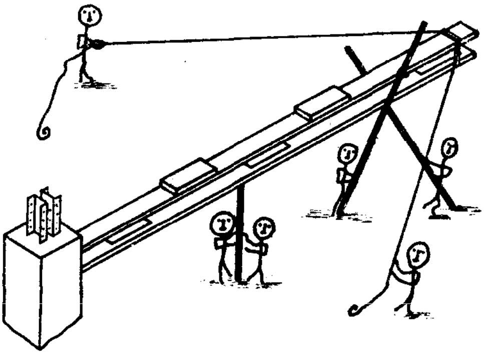
12. MARKING AND STORING OF TIMBER POSTS BEFORE ERECTION

12.1 Marking — Each post shall be marked showing clearly bottom and top end of the post so as to avoid any possible mistake during erection. The information on species of timber and the year of preservative treatment shall also be marked on the post, at a distance of 2·5 m from the bottom end.

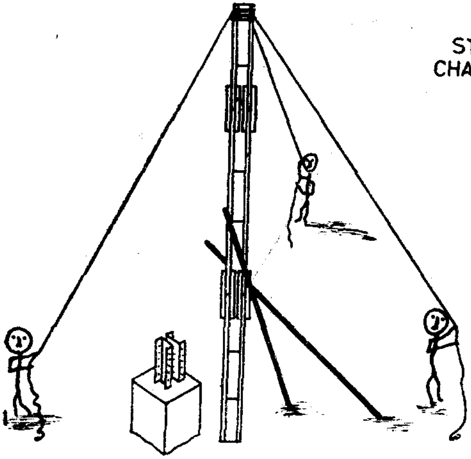
12.2 Fabricated posts shall be stacked in such a manner as to provide free air circulation and minimum contact between individual pieces in each stack. The stacks shall be placed on studs which are at least 200 mm above the ground.

13. ERECTION OF POSTS

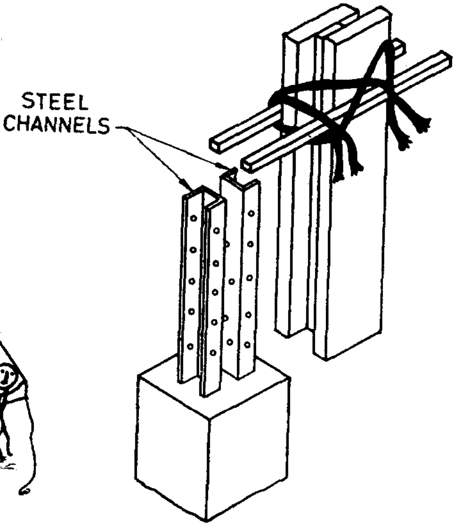
13.1 A simple method for erecting posts in the various stages is given in Fig. 3.



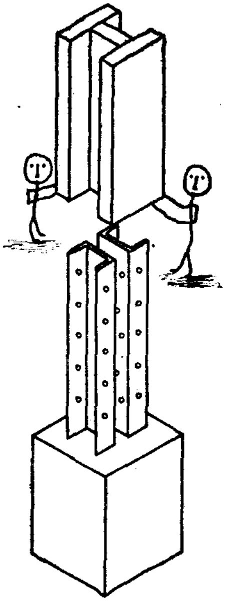
3A Post Being Erected by Manual Labour



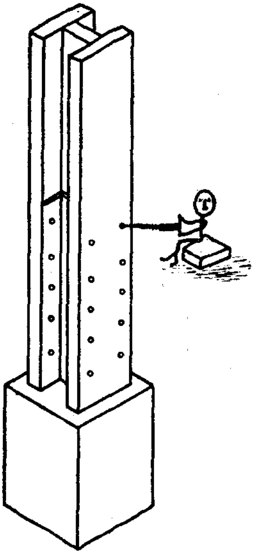
3B Post kept in Vertical Position Near the Dwarf Concrete Base



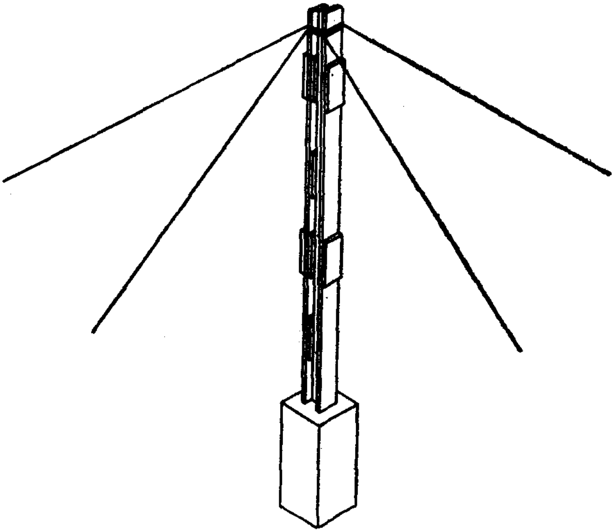
3C Two Small Timbers are Tightened at the Bottom for Bodily Lifting the Post



3D Post Being Placed Between the Two Steel Channels



3E Semi-Skilled Carpenter Doing the Job of Preboring for Bolting the Post with MS Channels Bolting Rigidly and Finishing



3F Showing the Post Being Embedded in Ground and Encased with Cement Concrete
(Without Use of Steel Channels)

FIG. 3 ERECTION TECHNIQUE

14. PAINTING AND MAINTENANCE

14.1 Each post shall be given decorative-cum-protective painting as below:

a) One priming coat, for example, aluminium wood primer or white lead primer or genuine pink primer. For timbers containing substances which retard the drying of oil paints, aluminium wood primer shall be used.
b) One coat of synthetic enamel under coat, and
c) One coat of finishing paint of synthetic enamel paint.

14.2 Any portion of timber expected to remain concealed, for example joints, shall be painted with the primer before assembly. During the service period surface painting with waterproof synthetic enamel paint shall be done every 3 to 5 years throughout the life of the post.

14.3 One G.I. sheet cap shall be fitted at the top of the post for prevention of rain-water or moisture entering through the end.

APPENDIX A

(*Clause* 4.1)

INDIAN STRUCTURAL TIMBERS FOR MAKING FABRICATED OVERHEAD ELECTRIC DISTRIBUTION POST

A-0. GENERAL

A-0.1 Generally speaking, most of the Indian structural timbers both coniferous and non-coniferous (hard woods) are suitable for making of fabricated timber transmission post. Due to vagaries of weather, to which these are subjected, only those species should preferably be used which can withstand warping, twisting and splitting, and heartwood of which is naturally durable, as also treatable and with much of sapwood surrounding it so as to render effective chemical treatment.

A-1. CHOICE OF TIMBER

A-1.1 Based on the above contention and backed by proof-tests on prototype various species have been recommended in order of their relative suitability divided into three choices (each choice again divided into three preferences).

A-1.2 First Choice — Naturally durable species with natural high durability in their heartwood. They do not require further treatment when heartwood alone is used provided there is no sign of sapwood or deterioration. Sapwood of all such species is easily treatable under simple processes while the heartwood of many species cannot be impregnated satisfactorily with wood preservatives. In view of this use of a greater portion of sapwood contents of these species is recommended in treated timber posts.

TABLE 2 SPECIES OF TIMBER UNDER FIRST CHOICE

SL No.	BOTANICAL NAME	TRADE NAME	REFRACTORINESS TO ALL SEASONING	PREFERENCE TO BE GIVEN (SUBJECT TO AVAILABILITY) BASED ON COL (4)
(1)	(2)	(3)	(4)	(5)
1.	*Acacia catechu*	khair	High	III
2.	*Albizzia odoratissima*	kala siris	High	III
3.	*Balanocarpus utilis*	karung kongoo	High	III
4.	*Hopea glabra* or *Hopea parviflora*	hopea	High	III
5.	*Mesua ferrea*	mesua	High	III
6.	*Mimusops elengi*	bulletwood	High	III
7.	*Pterocarpus santalinus*	red sanders	High	III
8.	*Shorea robusta*	sal	High	III
9.	*Vitex altissima*	milla	High	III
10.	*Bassia butyracea*	hill mahua	Moderate	II
11.	*Albizzia lebbeck*	kokko	High	III
12.	*Carapa moluccensis*	pussur	Moderate	II
13.	*Dysoxylum malabaricum*	white cedar	Moderate	II
14.	*Gluta travancorica*	gluta	High	III
15.	*Hardwickia pipnnate*	piney	Moderate	II
16.	*Eucalyptus eugenioides*	eucalyptus (highly warping)	High	III
17.	*Lagerstroemia lanceolata*	Benteak	Moderate	II
18.	*Pterocarpus dalbergioides*	padauck	Moderate	II
19.	*Pterocarpus marsupium*	bijasal	Moderate	II
20.	*Soymida febrifuga*	rohini	High	III
21.	*Tectona grandis*	teak	Moderate	II
22.	*Xylia xylocarpa*	irul	High	III
23.	*Artocarpus intogrifolius*	kathal	Moderate	II
24.	*Artocarpus lakooch*	lakooch	Moderate	II
25.	*Careya arborea*	kumbi	High	III
26.	*Cedrus deodara*	deodar	Scarcely	I
27.	*Cupressus torulosa*	cypress	Scarcely	I
28.	*Dalbergia latifolia*	Indian rose wood	Moderate	II
29.	*Dalbergia sissoo*	sissoo	Moderate	II
30.	*Gmelina arborea*	gamari	Moderate	II
31.	*Hardwickia binata*	anjan	High	III
32.	*Ougeniia dalbergioides*	sandan	Moderate	II

A-1.3 Second Choice — Moderately durable or non-durable species in their heartwood but whose heartwood can satisfactorily or reasonably satisfactorily be treated depending upon treatability class in small thickness up to 60 mm by simple process.

TABLE 3 SPECIES OF TIMBER UNDER SECOND CHOICE

Sl No.	Botanical Name	Trade Name	Refractoriness to All Seasoning	Preference to be Given (Subject to availability) Based on Col (4)
(1)	(2)	(3)	(4)	(5)
1.	*Acrocarpus fraxinifolius*	mundani	Moderate	II
2.	*Acacia arabica*	babul	Moderate	II
3.	*Adina cordifolia*	haldu	Moderate	II
4.	*Albizzia procera*	white siris	Moderate	II
5.	*Anthocephalus cadamb*	kadam	Scarcely	I
6.	*Cynometra polyandra*	ping	Moderate	II
7.	*Casuarina equisetifolia*	casuarina	High	III
8.	*Cullenia excelsa Rosaynoana*	karani	Scarcely	I
9.	*Castanopsis hystrix*	Indian chest-nut	Moderate	II
10.	*Chukrassia tabularis*	chickrassy	Moderate	II
11.	*Cedrela*	toon	Moderate	II
12.	*Dipterocarpus-macrocarpus*	hollong	Moderate	II
13.	*Dipterocarpus*	garjan	Moderate	II
14.	*Dillenia*	dillenia	Moderate	II
15.	*Holoptelea integrifolia*	kanju	Moderate	II
16.	*Mangifera indica*	mango	Moderate	II
17.	*Mitragyna parvifolia*	kaim	Moderate	II
18.	*Pterospermum acerifolium*	hathipalia	Moderate	II
19.	*Phoebe*	bonsum	Moderate	II
20.	*Pinus wallichiana*	chir	Scarcely	I
21.	*Pinus excelsa*	kail	Scarcely	I
22.	*Quercus*	oak	High	III
23.	*Stereospermum chelonoides*	padriwood	Moderate	II
24.	*Swintonia floribunda*	civit	Moderate	II
25.	*Terminalia arjuna*	arjun	Moderate	II
26.	*Terminalia myriocarpa*	hollock	Moderate	II
27.	*Terminalia bellerica*	bahera	Moderate	II
28.	*Terminalia Manii*	black chuglam	Moderate	II
29.	*Terminalia chebula*	harda	High	III
30.	*Terminalia tomentosa*	laurel	High	III
31.	*Schleichera trijuga*	kusum	High	III

A-1.4 Third Choice — Moderately durable and non-treatable species in their heartwood but whose treatability can be improved for small sizes (thickness up to 60 mm) under pressure process.

TABLE 4 SPECIES OF TIMBER UNDER THIRD CHOICE

SL No. (1)	BOTANICAL NAME (2)	TRADE NAME (3)	REFRACTORINESS TO ALL SEASONING (4)	PREFERENCE TO BE GIVEN (SUBJECT TO AVAILABILITY) BASED ON COL (4) (5)
1.	*Anogeissus acuminata*	yon	High	III
2.	*Altingia excelsa*	jutili	High	III
3.	*Amoora*	amoora	Moderate	II
4.	*Artocarpus chaplasha*	chaplash	Moderate	II
5.	*Bridelia retusa*	kasi	Moderate	II
6.	*Carallia lucida*	carallia (maniagwa)	Moderate	II
7.	*Calophyllum*	poon	Moderate	II
8.	*Dichopsis polyantha elliptica*	pali & tali	Moderate	II
9.	*Eugenia*	juman	High	III
10.	*Elaeocarpus tuberculatus*	rudrak	Scarcely	I
11.	*Crewia vestita*	dhaman	High	III
12.	*Lagerstroemia hypoleuce*	pyinma or jarul	Moderate	II
13.	*Podo-Carpus*	thitmin	Moderate	II
14.	*Poeciloneuron indicum*	ballagi	High	III
15.	*Temminalia paniculata*	kindal	High	III

INDIAN STANDARDS

ON

TIMBER ENGINEERING

IS:
883-1970 Code of practice for use of structural timber in building (*third revision*)
2366-1963 Code of practice for nail-jointed timber construction
2700-1964 Code of practice for roofing with wooden shingles
3629-1966 Specification for structural timber in building
3630-1966 Code of practice for construction of non-load bearing gypsum block partitions
3670-1966 Code of practice for construction of timber floors
4891-1968 Specification for preferred cut sizes of structural timber
4924 (Part I)-1968 Method of test for nail-jointed timber trusses: Part I Destructive test
4924 (Part II)- 1968 Method of test for nail-jointed timber trusses: Part II Proof test
4983-1968 Code of practice for nailed laminated timber beams
5389-1969 Code of practice for laying of parquet and wood block floors
5390-1969 Code of practice for construction of timber ceilings
6313 (Part I)-1971 Code of practice for anti-termite measures in buildings: Part I Constructional measures
6313 (Part II)-1971 Code of practice for anti-termite measures in buildings: Part II Preconstructional chemical treatment measures
6313 (Part III)-1971 Code of practice for anti-termite measures in buildings: Part III Treatment for existing buildings
7683-1975 Code of practice for design, fabrication and maintenance of nail-jointed timber posts from small dimensional timber for overhead electric distribution lines for low voltages

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